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IN THE UNITED STATES PATENT & TRADEMARK OFFICE  
before the  
Board of Patent Appeals and Interferences

Appln. Ser. No.:	Filed:	Inventor(s):	Atty Dkt:
09/543,951	6 April 2000	W. Dalton	1633-015A
Title: Improved Brush Seal Designs for Turbines and Similar Rotary Apparatus			
Examiner: M. Rogers			Art Unit: 3677

Asst. Comm'r for Patents  
Washington, D.C. 20231-0001

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**Brief on Appeal**

GROUP 3600

Dear Sir:

In connection with the Notice of Appeal filed herewith, Applicants hereby submit this brief on appeal, in triplicate, along with a check for the fee amount of \$ 320.00 under 37 C.F.R. § 1.17(c). If the check is missing, or if this paper should necessitate any fees not provided, or if there has been an overpayment, please debit or credit, as necessary, the firm's Deposit Acct. No. 502144.

**Real Party in Interest**

The real party in interest owning this application is TurboCare, Inc.

**Related Appeals/Interferences**

There are no related appeals or interferences regarding this application.

## **Status of the Claims**

Claims 1-9 are pending and finally rejected.

## **Status of Amendments after the Final Rejection**

A first Response, but no amendments, was submitted by facsimile after the final rejection on 3 February 2003. An Advisory action (paper no. 18) indicated that the response would be entered for purposes of appeal.

A second Response with amendments was submitted by facsimile on 26 March 2003, and the Advisory action (paper no. 20) indicated that the amendments would not be entered.

## **Summary of the Invention**

The invention relates to seals used in rotary machinery such as steam turbines. (Page 1, lines 5-7.) In general, a working fluid, such as steam, is sent through a plurality of stages wherein work is extracted from the fluid at each stage. (Pg. 2; ln. 3-19.) More particularly, the angular momentum of the working fluid is transferred to blades attached to the circumference of the turbine shaft. (*Ibid.*)

The rotary machinery thus includes stationary (fixed) portions and moving portions. There are fluid seals separating the stationary and moving portions. (Pg. 2; ln. 20-23.) These seals typically have a ring structure with multiple rows of fins pointed towards the shaft, often termed a labyrinth seal. (Pg. 3, ln. 11-15.)

One of the main areas where seals are needed is between the casing and the rotor. (Page 3, first full paragraph; as amended by the amendment submitted contemporaneously with this brief.) During start-up and shut down there are

differential heating and vibration modes that cause the shaft to tend to rub against and damage the seals. Accordingly, the art (Brandon, cited) has developed "retractable" seals that move radially away from the shaft during start-up and shut down, and move to a closed position during normal operation. (Paragraph bridging pages 3 and 4.)

Another type of seal used in such devices is a brush seal. (Paragraph bridging pages 4 and 5.) These devices are described in fixed, immovable seals. (Pg. 4, ln. 23-24.) Accordingly, these brushes can be damaged in the same manner in which the fin-type labyrinth seals are damaged.

The invention claimed is a hybrid fin and brush seal that is also retractable.

### **Statement of the Issue**

On the sole ground for rejection, would all of the pending claims 1-9 have been obvious over the combination of Brandon (US 5,810,365) and Bagepalli (*et al.*) (US 6,030,175)? More particularly, the issue is whether the manner in which the rejection uses the secondary reference in the rejection is proper.

### **Grouping of Claims**

Claims 1 and 6 stand apart.

### **Argument**

The two references on which the obviousness rejection is based are Brandon and Bagepalli. There is no disagreement that Brandon discloses a fin-type labyrinth retractable seal, and such is acknowledged in the application (as

noted above). The contention is whether Bagepalli can be properly combined with Brandon.

The present independent claims 1 and 6, as presented in the Request for Continued Examination, recite the particular structure of the seal as having, *inter alia*:

an inner face for sealing against said shaft and an outer face supporting a T-shaped extension, said inner and outer faces and said extension spanning opposing side ends, said side ends cut parallel with radii of said axis; and

at least one brush seal disposed on the inner face of said segment, said brush seal having opposing ends, at least one of said ends cut non-parallel with radii of said axis.

Claim 6 more specifically recites a tongue and groove interface between adjacent seal and brush segments.

Applicants underline language in this quotation to emphasize that the claim recites certain key aspects that provide a functional, retractable hybrid fin-brush hybrid seal, and the absence of these aspects in a proper combination of the prior art references is fatal to the proper combination of references.

As stated by the Examiner in the Advisory Action (paper no. 18):  
As stated in the final action mailed January 27<sup>th</sup>, 2003 the Bagepalli reference is used as a TEACHING to suggest to one with ordinary skill in the art that a brush seal having ends cut non-parallel with the radii of the axis of the shaft may be incorporated in use with a labyrinth seal and therefore would motivate one with ordinary skill in the art to use a brush seal having ends cut non-parallel with the radii of the axis of the shaft with the labyrinth seal of Brandon.

Applicants contend that this basis for the combination of references is improper because it is impermissible within the framework of Sec. 103 to pick and choose only so much of a reference disclosure as will support the rejection

while failing to account for the context of that disclosure which is contrary to the rejection. *E.g.*, *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve, Inc.*, 230 USPQ 416, 419-420 (Fed. Cir. 1986), *cert. denied*, 108 S.Ct. 85 (1987); *Dennison Manufacturing Company v. Panduit Corp.*, 475 US 809, 229 USPQ 478, 479 (1986); *In re Wesslau*, 147 USPQ 391, 393 (C.C.P.A. 1965); *In re Mercier*, 185 USPQ 774, 778 (C.C.P.A. 1975) (“all of the relevant teachings of the cited references must be considered in determining what they fairly teach to one having ordinary skill in the art.” (emphasis in original)). Those teachings of the reference that lead one away from the claimed invention must be taken into account. *In re Marshall*, 198 U.S.P.Q. 344 (C.C.P.A. 1978).

Bagepalli does teach a brush seal in a fin labyrinth having ends cut non-parallel with the radii of the shaft. Nonetheless, Bagepalli provides such a teaching only in the context of a non-retractable seal. Brandon and the present invention are directed to retractable seals. As explained in the declaration under § 1.132 of Richard Shifler filed in response to paper no. 6 (and originally submitted in another application, now allowed), it is not straightforward to add a brush seal to a conventional retractable seal (*e.g.*, ¶¶24-32 of the Shifler declaration) because of the complex interaction of forces tending to open and close the seal (¶26 of the Shifler declaration).

The structure of the Bagepalli device has an overlapping offset, as shown, for example, by the joints 50 and 58 in Fig. 1 of Bagepalli. As stated in the declaration under § 1.132 of Eric Sulda (submitted in response to paper no. 14), this overlapping arrangement would restrict or hinder radial movement necessary for a retractable seal (¶16 of the Sulda declaration). Mr. Sulda also notes (¶17) that while the Bagepalli structure could theoretically be used as a retractable

seal, the reality of a turbine environment, with differences in spring forces tending to open (retract) the seals, differing steam pressure around the seals, and different frictional forces between each of the multiple segments, prevents the Bagepalli structure from being used as retractable seal.

It is for these reasons of real operating conditions that the present claims recite that the inner and outer faces of the segment, and the T-shaped extension thereon, span common opposing ends that are cut along radii of the shaft, and why the Brandon patent shows the same. The Examiner alleges in the final rejection (paper no. 16) that there is no indication in the references that the differing or different spring, steam, and frictional forces in a real turbine would present a problem with retraction of the seal, but silence in a reference is no substitute for an adequate disclosure of facts on which a conclusion of obviousness must be based, *In re Burt*, 148 USPQ 548, 553 (C.C.P.A. 1966), and such silence does not controvert or even draw into question the statements made in the Sulda declaration.

Further, Examiner may not substitute his own speculations for the factual knowledge of those skilled in the art, and Mr. Sulda's declaration requires the Office to come forth with further factual support for the conclusion of obviousness. *In re Katzschmann*, 146 U.S.P.Q. 66 (C.C.P.A. 1965). Thus, it is improper, and insufficient, for the Examiner to "assert[]" that there is no indication in either the description of the springs (16) of Brandon or the surfaces of Bagepalli that this [uneven spring force and friction] is true" (final rejection at page 4, ln. 15-16) absent providing a reference under § 1.104(d)(1) or an affidavit of personal knowledge under § 1.104(d)(2) to support the Office's position. Otherwise, the analysis of whether the *prima facie* case of obviousness exists must be started

anew based on the evidence of record, not the previous conclusion of obviousness. *In re Eli Lilly & Co.*, 14 USPQ2d 1741 (Fed. Cir. 1990); *In re Rinehart*, 189 USPQ 143 (C.C.P.A. 1976).

The Office has not adequately considered the affidavit evidence and is improperly maintaining the obviousness rejection.

Graham is interpreted as continuing to place the "burden of proof on the Patent Office which requires it to produce the factual basis for its rejection of an application under sections 102 and 103". *In re Warner*, 379 F.2d 1011, 1016, 154 USPQ 173, 177 (CCPA 1967).

*In re Piasecki*, 223 USPQ 785, 788 (Fed. Cir. 1984). "If rebuttal evidence of adequate weight is produced, the holding of prima facie obviousness, being but a legal inference from previously uncontradicted evidence, is dissipated.

Regardless of whether the prima facie case would have been characterized as strong or weak, the examiner must consider all of the evidence anew." *Id.*

Applicant has referred to 37 C.F.R. § 1.104 in all responses and in the First Response to Final Office Action specifically referred to § 1.104 and requested that the Examiner provide support thereunder for the refutation of points in Mr. Sulda's declaration.

Returning to the substance of the references, the Bagepalli structure is not only self-described as non-retractable, but the structure of the seal segment and the brush are designed to prevent the sharp edges of the brush, cut at an angle, from causing injuries during handling (Bagepalli at col. 1, ln. 42-47). It is for this reason that the T-shaped extension (mounting block 30 in Fig. 2) of Bagepalli is offset circumferentially from the "seal segments" (26 and 28 in Fig. 2 of Bagepalli;

see col. 2, ln. 3-12)<sup>1</sup> in order to recess the “sharp” end of the brush and avoid worker injury (compare perspectives in Bagepalli of Fig. 2 with the opposite end shown in Fig. 3). The Bagepalli disclosure of a brush with canted ends is directed to a particular end, preventing injuries to workers handling such segments. The claimed structure is directly contrary to that disclosure by having the “sharp” end of the brush extend beyond the segment end (see Applicants’ Figs. 2A and 3), as recited in the claims, especially claim 6 requiring the tongue and groove.

The Examiner’s contention that Bagepalli “is used as a teaching to show that it is well known in the art to provide, in part, a labyrinth seal arrangement with a brush seal and is therefore not taken out of context of the surrounding structure in which it is housed” (final rejection at page 3, last sentence) does indeed take the brush out of context to pick and choose only what is needed to support the rejection. Both declarations, from Shifler and Sulda, explain that a stationary seal is not comparable to a retractable seal. Yet using the “teaching” of the combination of the brush with the labyrinth, or the brush in a turbine seal, clearly ignores, or avoids, whatever context is different from the claimed retractable seal to support the combination. The only reason for Bagepalli to provide a brush seal, according to Bagepalli, is that the brush end is recessed in the space caused by the circumferential offset between the bottom seal and the T-shaped extension on top. Bagepalli does not even describe any art where a brush is used in combination with a stationary seal<sup>2</sup>, and teaches only that such hybrid

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<sup>1</sup> It should be noted that Applicants define a “seal segment” as the entire structure shown in Fig. 2 of Bagepalli, whereas Bagepalli defines a “seal segment” as each of the separate segments 26 and 28 to which the mounting block 30 is attached.

<sup>2</sup> Although Applicants are aware of the Skinner patent cited on the face of Bagepalli, as directed to a stationary seal with a brush, the Skinner brush has an



seals have been "proposed." (Col. 1, ln. 30.) Presumably the reason such hybrid seals were not adopted is because of the worker hazard issue seen by Bagepalli.

Applicants thus contend that Brandon and Bagepalli cannot be properly combined. While both relate to turbine seals, disclose the use of labyrinth seals, and have a T-shaped extension (for fitting into the same casing structure as Applicants' T-shaped extension), in between the connection to the casing (the extension) and the sealing of the shaft (the labyrinth), the two seals are so different as not to be properly combined for the purpose of rendering the claimed invention obvious. The differences between Bagepalli and Brandon appear to be small in number, namely the circumferential offset between the extension and the labyrinth/brush seal in Bagepalli, and the holes 22 and springs 16 of Brandon. Yet these differences are stark when one looks at how the seals function in the environment of a turbine. Brandon's device retracts at low pressures such as during start-up and shut down. Bagepalli's device is stationary and has an additional labyrinth in the form of the brush. The two declarations (Shifler and Sulda) attest to the differences between stationary and retractable turbine seals. Each of Bagepalli's and Brandon's seals would have to be significantly changed to work in the other's environment.

While the motivation for the combination of references might be better sealing, there is nothing in the references to suggest how to combine the references with any reasonable degree of success. *Smiths Industries Medical Systems Inc. v. Vital Signs Inc.*, 51 USPQ2d 1415 (Fed. Cir. 1999). Rather, the

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opening in the brush circumference.

declarations by Messrs. Shifler and Sulda attest to the difficulties in the apparently simple inclusion of a brush into a retractable seal.

The Examiner's citation of *Keller* regarding what the combined teachings of the references suggest should also note that Court's affirmation that a declaration by one of ordinary skill in the art can rebut the *prima facie* case of obviousness and shift the burden back to the Office. In *Keller*, the primary references (Keller and Berkovits) taught cardiac stimulators using R-C circuits, and the secondary reference Walsh taught a digital timer in place of an R-C circuit, hence the rejection alleged the obviousness of a digital timer for a cardiac pacer. The affidavit submitted in *Keller* concerned only the Walsh reference, not the combination. In the present case, the declarations (affidavits) explain why the combination is unworkable. For example, as explained essentially in Mr. Sulda's declaration, Bagepalli could be modified by putting holes in the ends of the segments and placing springs between abutting segments, as taught by Brandon for a retractable seal. Yet Mr. Sulda's declaration explains why that modified seal (with or without the brush) will not function as a retractable seal, because of uneven spring and frictional forces and the circumferential offset. That is what the combination teaches. To take only certain parts of the structure, such as only the brush, is to ignore what the references fairly suggest to one of ordinary skill in the art. A reference is not a repository of individual elements, but is directed to a functional device, and the deconstruction of that device into component parts for use in another device must be done with the artisan's knowledge that the components were designed for a particular reason. As explained in Mr. Shifler's declaration, putting a brush in a retractable seal is not straightforward, so merely combining the brush of Bagepalli with the retractable seal of Brandon is improper.

And Mr. Sulda explains why adding more of the Bagepalli structure in the combination *prima facie* defeats the intent of having a retractable seal.

While claims 1 and 6 are similar, as mentioned above, claim 6 differs slightly from claim 1 in more particularly pointing out that one end of the segment present the brush as a tongue, and the other presents a "groove for accepting a tongue formed by a brush seal on an adjacent packing segment." The groove (305) is shown in Fig. 3, and in perspective in Fig. 2B. The corresponding structure in Bagepalli is different. If the channel 46 in Fig. 2 of Bagepalli corresponds with Applicants' groove, then there is no structure in Bagepalli corresponding to Applicants' tongue (303 in Applicants' Fig. 3) because it occurs on the same end of the seal segment. Claim 6 specifically recites that the brush portion has "a tongue extending past the segment side end" and Bagepalli has no portion of the brush extending past the segment side end; as the term "segment" is defined by Applicants (see footnote 1). Accordingly, even if claim 1 were to be found unpatentable, claim 6 is different and describes structure that would not have been obvious from the references.

In light of the foregoing, it is urged that the Board find that the *prima facie* case of obviousness has been overcome and reverse the rejection.

Respectfully submitted,



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## APPENDIX OF CLAIMS ON APPEAL

1. (Twice amended.) A retractable packing segment for an apparatus that extracts work from the expansion of a gaseous working fluid, said apparatus comprising:

a rotating shaft disposed in a casing,

a plurality of packing segments disposed in a ring and centered on an axis defined by said shaft to provide a seal therearound,

said retractable packing segment comprising:

an inner face for sealing against said shaft and an outer face

supporting a T-shaped extension, said inner and outer faces and said extension spanning opposing side ends, said side ends cut parallel with radii of said axis; and

at least one brush seal disposed on the inner face of said segment, said brush seal having opposing ends, at least one of said ends cut non-parallel with radii of said axis.

2. The packing segment of claim 1, wherein both ends of said brush seal are cut non-parallel with radii of said axis.

3. The packing segment of claim 1, said inner face further comprising a plurality of fins.

4. The packing segment of claim 1, said inner face comprising a plurality of brush seals.

5. The packing segment of claim 3, wherein the fins extend different distances from the inner face.

6. (Twice Amended.) A retractable brush seal for an apparatus that extracts work from the expansion of a gaseous working fluid, said apparatus comprising:

a rotating shaft disposed in a casing,  
said brush seal in the geometry of a ring formed from a plurality of adjacent abutting packing segments and centered on an axis defined by said shaft to provide a brush seal therearound,

each said segment comprising:

an innerface for sealing against said shaft and an outer face  
supporting a T-shaped extension, said inner and outer faces  
and said extension spanning opposing side ends, said side  
ends cut parallel with radii of said axis; and;

at least one brush seal disposed on the inner face of said segment,  
said brush seal having opposing side ends cut non-parallel with  
radii of said axis, one of said side ends cut angled to form a  
tongue extending past the segment side end and the other of  
said brush seal ends cut at the same angle relative to said  
segment to provide a groove for accepting a tongue formed by  
a brush seal on an adjacent packing segment.

7. The brush seal of claim 6, said inner face further comprising a plurality of fins.

8. The brush seal of claim 6, said inner face comprising a plurality of brush seals.

9. The brush seal of claim 7, wherein the fins extend different distances from the inner face.